MANAGEMENT INFORMATION SYSTEMS 8/E

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Chapter 13

Decision Support Systems

Objectives

- Have an expanded theoretical base for understanding decision making and the DSS concept.
- Understand the objectives of a DSS.
- Understand one definition of a DSS and its accompanying model.
- Know how to apply the DSS concept to group problem solving and achieve a group decision support system/GDSS
- Be familiar with special GDSS software called groupware.
- Know what is meant by the term artificial intelligence as well as what areas are included.
- Understand the appeal of expert sistem and how they compare with DSSs.

Simon's Types of Decisions

- Programmed decisions
  - repetitive and routine
  - have a definite procedure
- Nonprogrammed decisions
  - Novel and unstructured
  - No cut-and-dried method for handling problem
- Types exist on a continuum

Simon's Problem Solving Phases

- Intelligence
  - Searching environment for conditions calling for a solution
- Design
  - Inventing, developing, and analyzing possible courses of action
- Choice
  - Selecting a course of action from those available
- Review
  - Assessing past choices

Definitions of a Decision Support System (DSS)

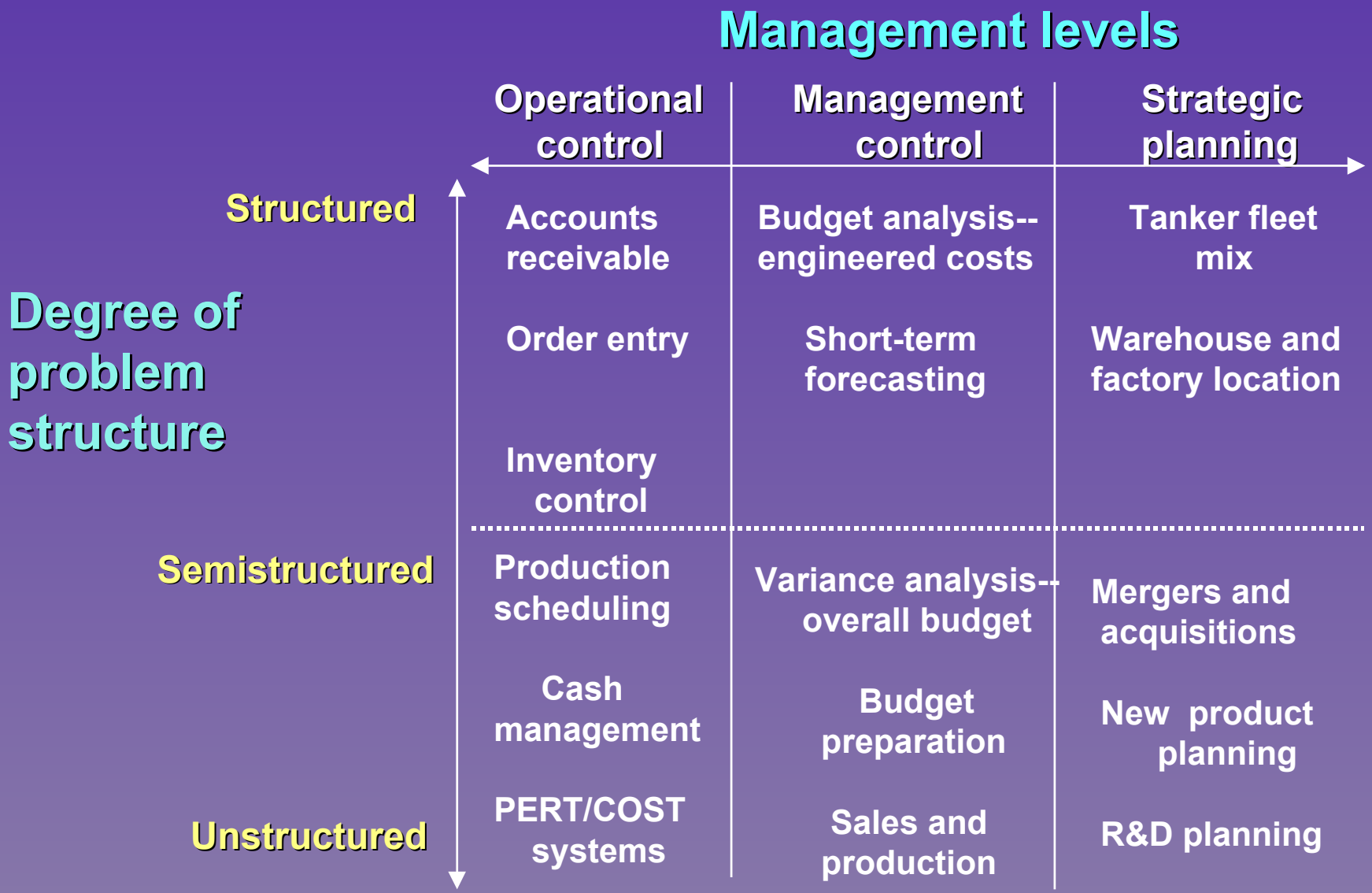
General definition - a system providing both problem-solving and communications capabilities for semistructured problems

Specific definition - a system that supports a single manager or a relatively small group of managers working as a problem-solving team in the solution of a semistructured problem by providing information or making suggestions concerning specific decisions.

The DSS Concept

- Gorry and Scott Morton coined the phrase 'DSS' in 1971, about ten years after MIS became popular
- Decision types in terms of problem structure
  - Structured problems can be solved with algorithms and decision rules
  - Unstructured problems have no structure in Simon's phases
  - Semistructured problems have structured and unstructured phases

The Gorry and Scott Morton Grid



Alter's DSS Types

- In 1976 Steven Alter, a doctoral student built on Gorry and Scott-Morton framework
  - Created a taxonomy of six DSS types
  - Based on a study of 56 DSSs
- Classifies DSSs based on "degree of problem solving support."

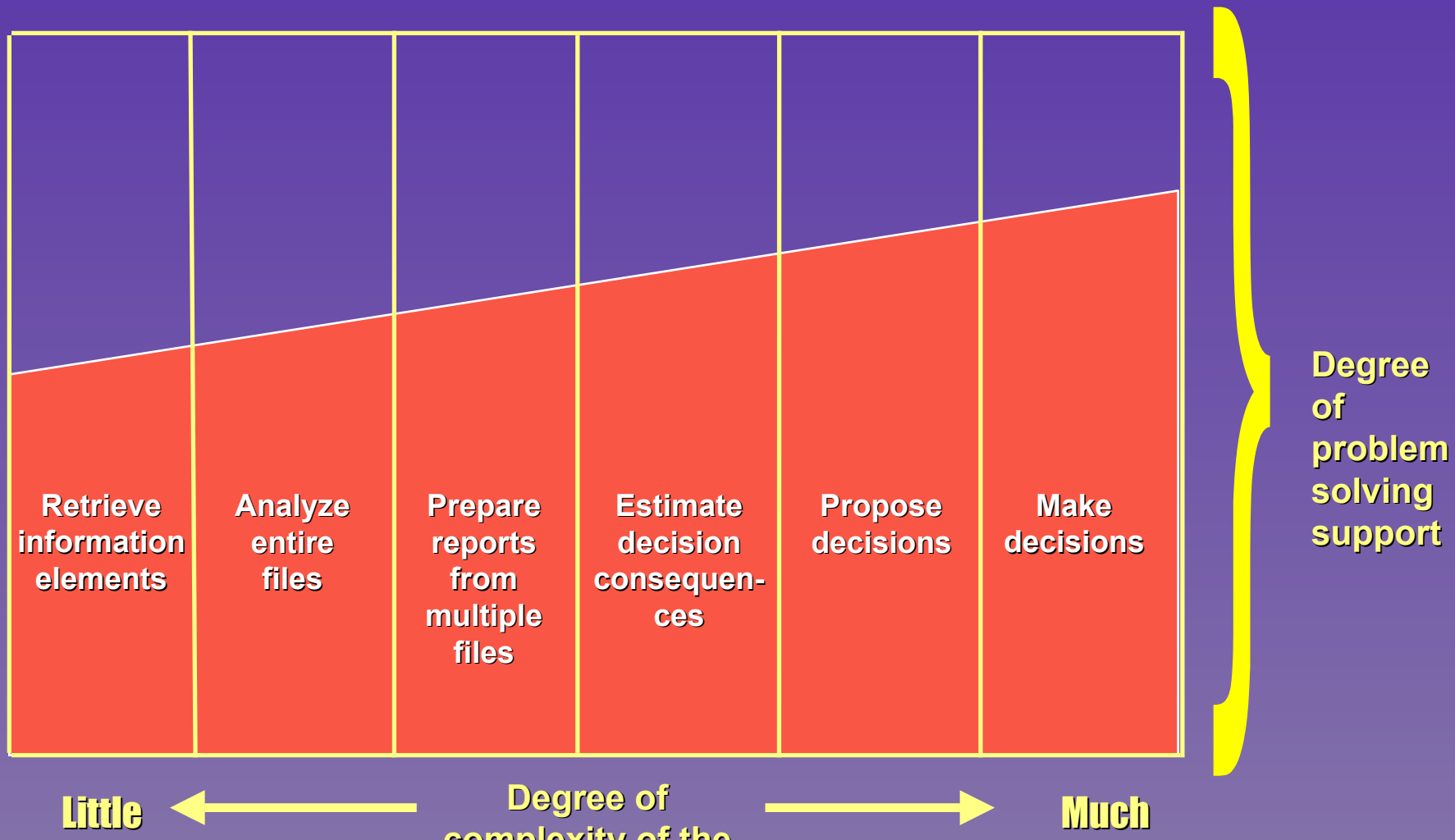
Levels of Alter's DSSs

- Level of problem-solving support from lowest to highest
  - Retrieval of information elements
  - Retrieval of information files
  - Creation of reports from multiple files
  - Estimation of decision consequences
  - Propose decisions
  - Make decisions

Importance of Alter's Study

- Supports concept of developing systems that address particular decisions
- Makes clear that DSSs need not be restricted to a particular application type

Alter's DSS Types

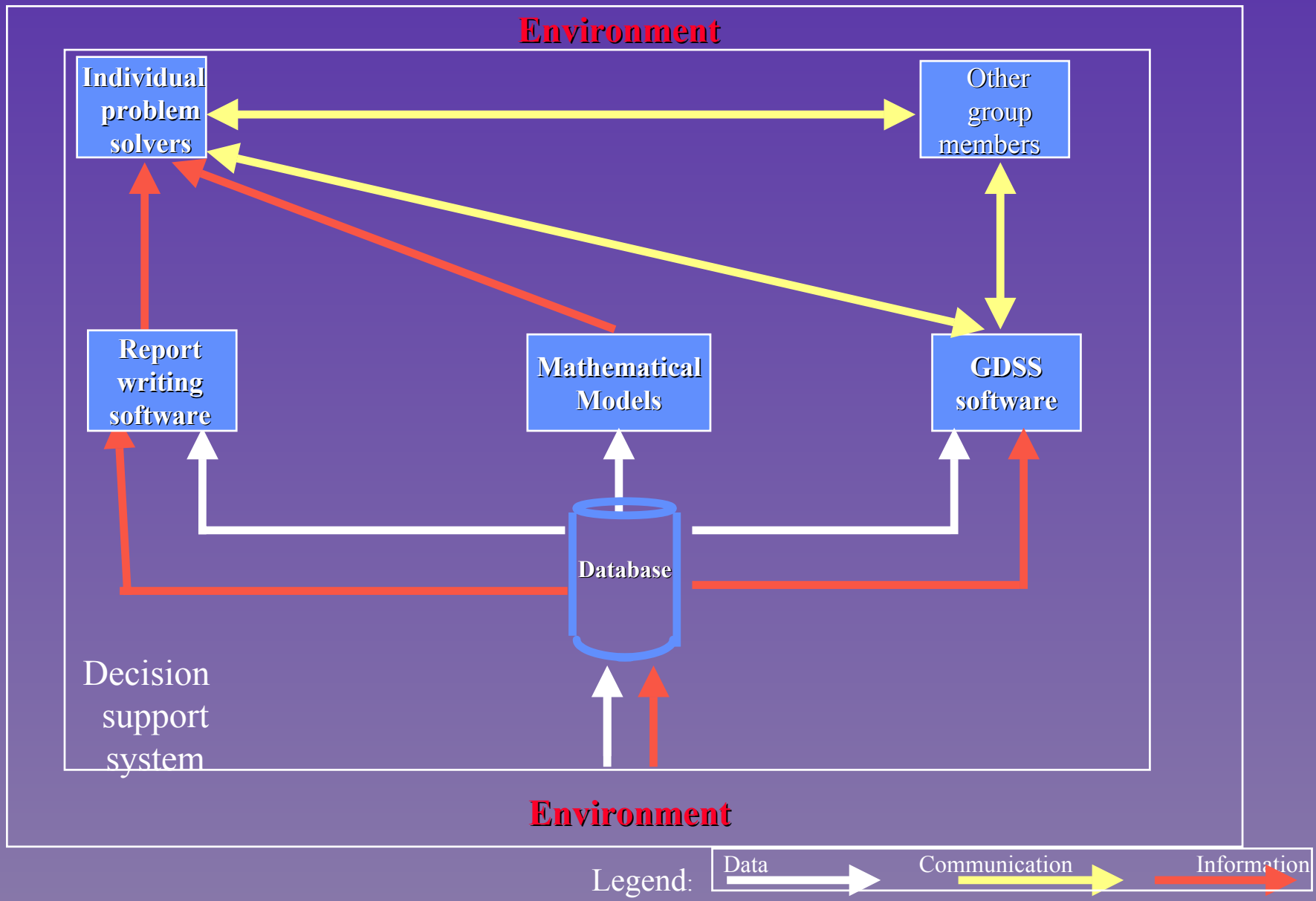


Three DSS Objectives

1. Assist in solving semistructured problems
2. Support, not replace, the manager
3. Contribute to decision effectiveness, rather than efficiency

Based on studies of Keen and Scott-Morton

A DSS Model


Environment
Individual problem solvers
Other group members
Report writing software
Mathematical Models
GDSS software
Database
Decision support system
Environment
Legend:
Data
Communication
Information

Database Contents

- Used by Three Software Subsystems
  - Report writers
    - » Special reports
    - » Periodic reports
    - » COBOL or PL/I
    - » DBMS
  - Mathematical models
    - » Simulations
    - » Special modeling languages
  - Groupware or GDSS

Group Decision Support Systems

- Computer-based system that supports groups of people engaged in a common task (or goal) and that provides an interface to a shared environment.
- Used in problem solving
- Related areas
  - Electronic meeting system (EMS)
  - Computer-supported cooperative work (CSCW)
  - Group support system (GSS)
  - Groupware

How GDSS Contributes to Problem Solving

- Improved communications
- Improved discussion focus
- Less wasted time

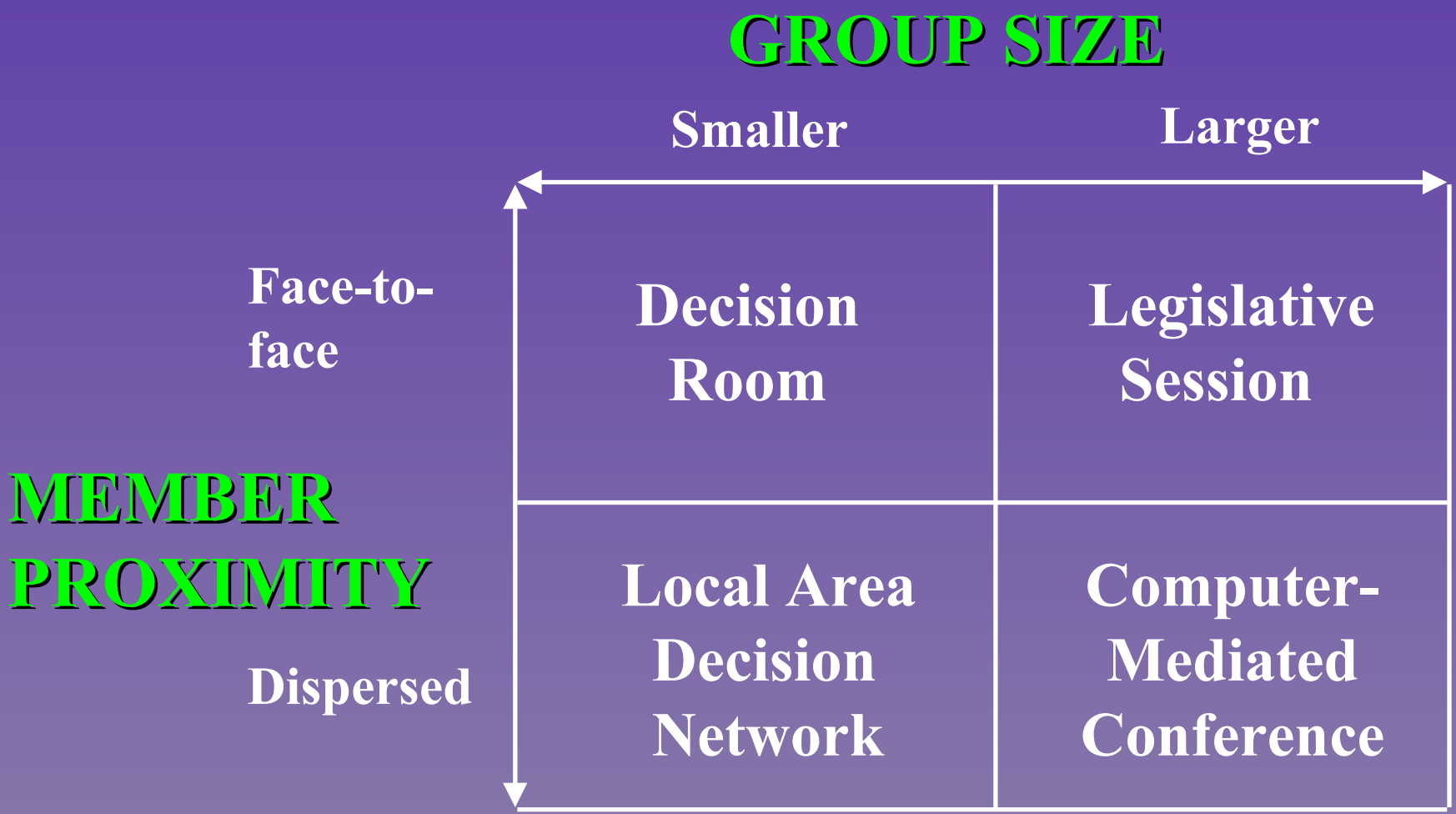
GDSS Environmental Settings

- Synchronous exchange
  - Members meet at same time
  - Committee meeting is an example
- Asynchronous exchange
  - Members meet at different times
  - E-mail is an example
- More balanced participation.

GDSS Types

- Decision rooms
  - Small groups face-to-face
  - Parallel communication
  - Anonymity
- Local area decision network
  - Members interact using a LAN
- Legislative session
  - Large group interaction
- Computer-mediated conference
  - Permits large, geographically dispersed group interaction

Group Size and Location Determine GDSS Environmental Settings



Groupware

- Functions
  - E-mail
  - FAX
  - Voice messaging
  - Internet access
- Lotus Notes
  - Popular groupware product
  - Handles data important to managers

Main Groupware Functions

Function	IBM Workgroup	TeamWARE Office	Lotus Notes	Novell GroupWise
Electronic mail	X	X	X	X
FAX	X	X	O	X
Voice messaging			O	X
Internet access	X	X	O	X
Bulletin board system		X	3	O
Personal calendaring	X	X	3	X
Group calendaring	X	X	O	X
Electronic conferencing	O	X	3	3
Task management	X	X	3	X
Desktop video conferen	O			
Database access	O	X	3	
Workflow routing	O	X	3	X
Reengineering	O	X	3	
Electronic forms	O	3	3	O
Group documents	O	X	X	O

X = standard feature O = optional feature 3 = third party offering

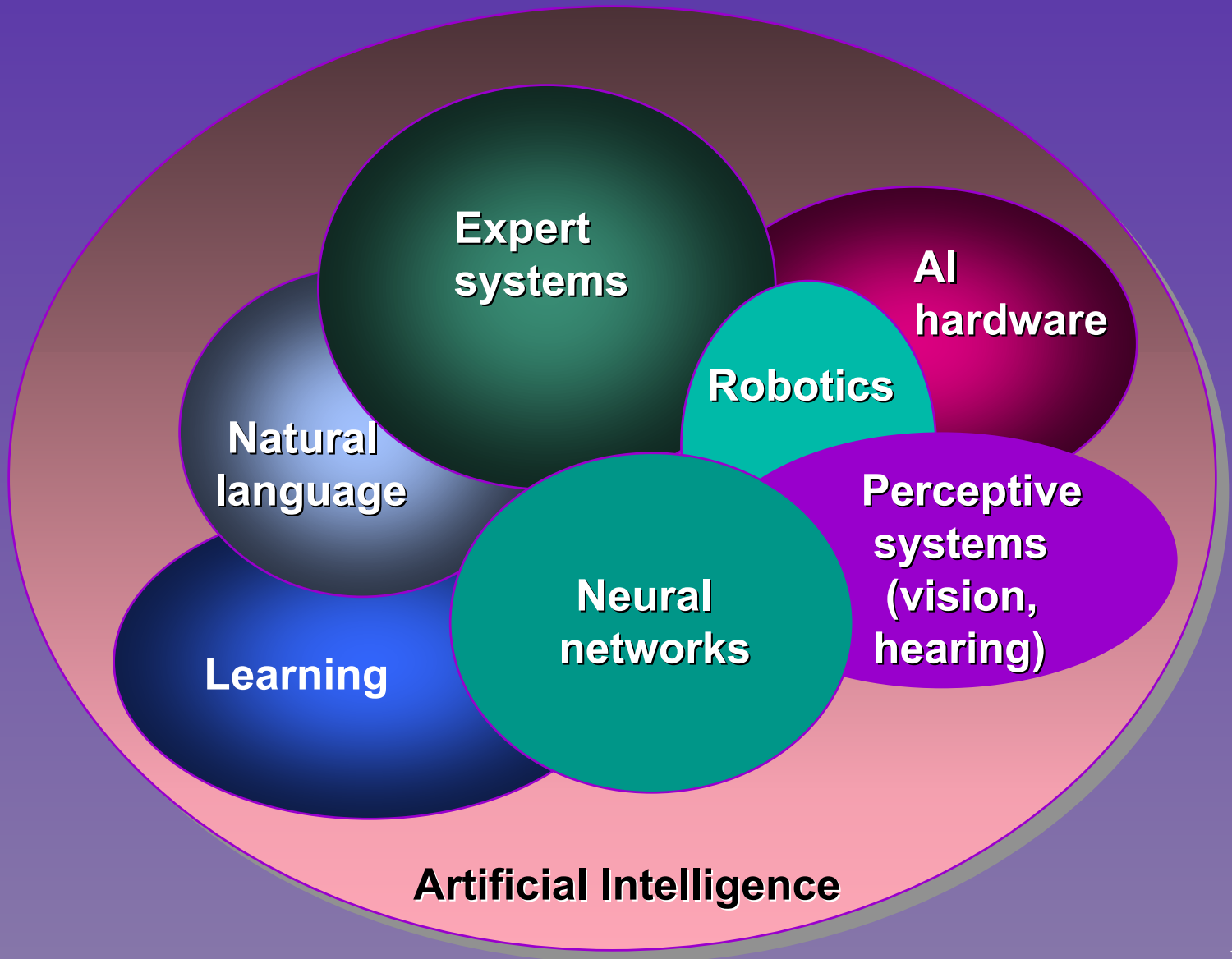
Artificial Intelligence (AI)

The activity of providing such machines as computers with the ability to display behavior that would be regarded as intelligent if it were observed in humans.

History of AI

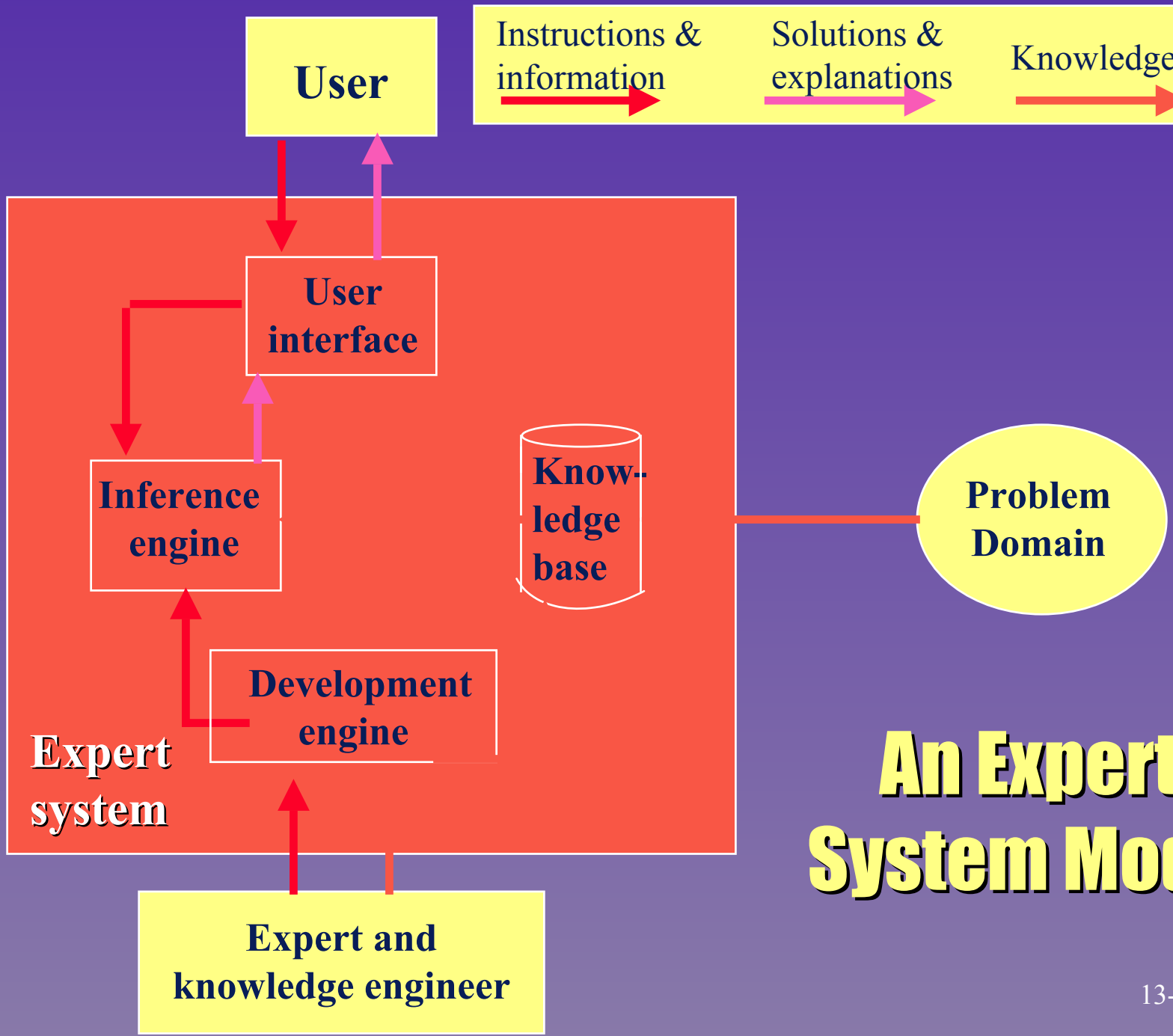
- Early history
  - John McCarthy coined term, AI, in 1956, at Dartmouth College conference.
  - Logic Theorist (first AI program. Herbert Simon played a part)
  - General problem solver (GPS)
- Past 2 decades
  - Research has taken a back seat to MIS and DSS development

Areas of Artificial Intelligence



Appeal of Expert Systems

- Computer program that codes the knowledge of human experts in the form of heuristics
- Two distinctions from DSS
  - 1. Has potential to extend manager's problem-solving ability
  - 2. Ability to explain how solution was reached



An Expert System Model

Expert System Model

- User interface
  - Allows user to interact with system
- Knowledge base
  - Houses accumulated knowledge
- Inference engine
  - Provides reasoning
  - Interprets knowledge base
- Development engine
  - Creates expert system

User Interface

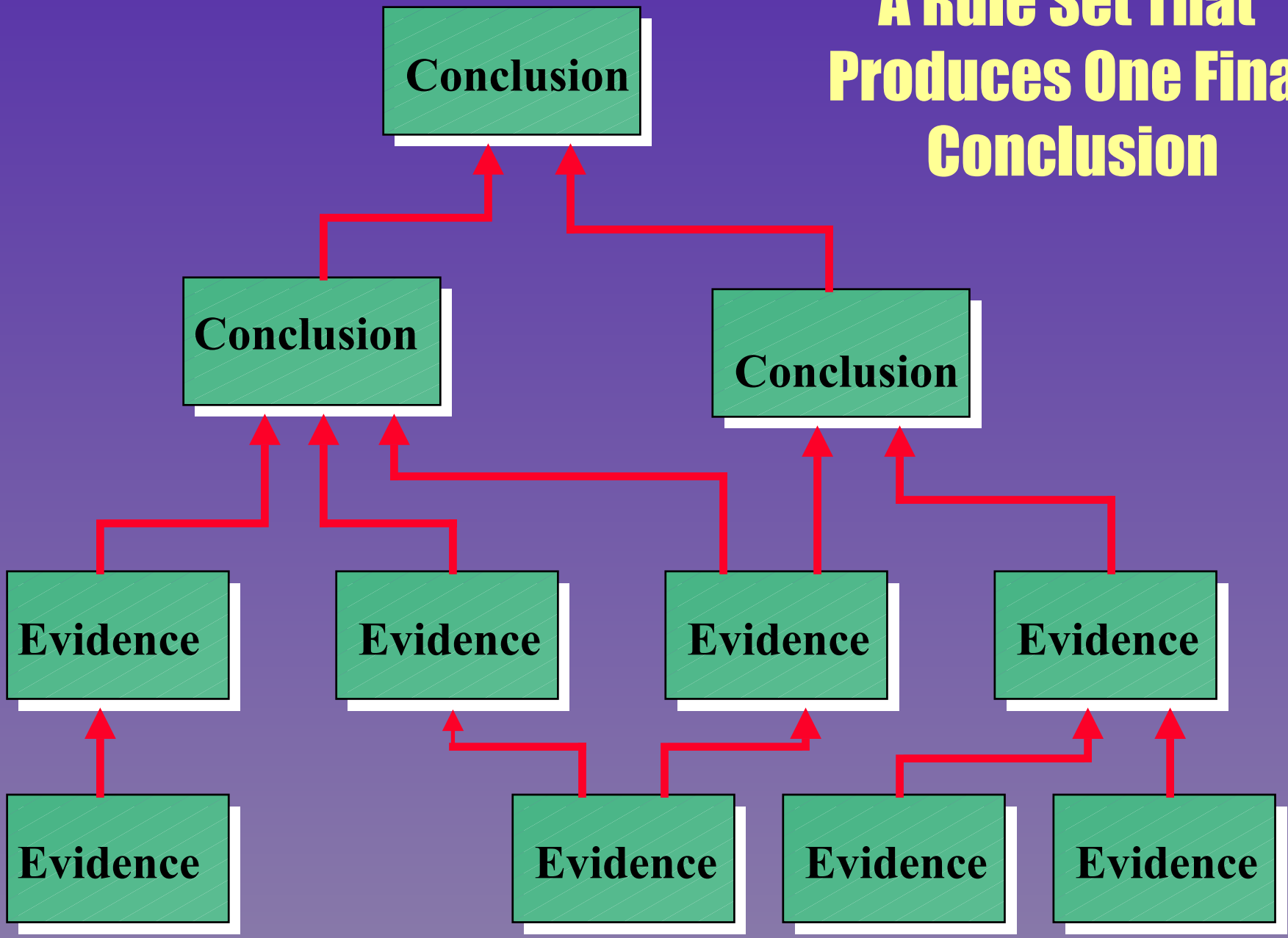
- User enters:
  - Instructions
  - Information

  } Menus, commands, natural language, GUI
- Expert system provides:
  - Solutions
  - Explanations of
    - » Questions
    - » Problem solutions

Knowledge Base

- Description of problem domain
- Rules
  - Knowledge representation technique
  - 'IF:THEN' logic
  - Networks of rules
    - » Lowest levels provide evidence
    - » Top levels produce 1 or more conclusions
    - » Conclusion is called a Goal variable.

A Rule Set That Produces One Final Conclusion



Rule Selection

- Selecting rules to efficiently solve a problem is difficult
- Some goals can be reached with only a few rules; rules 3 and 4 identify bird

Inference Engine

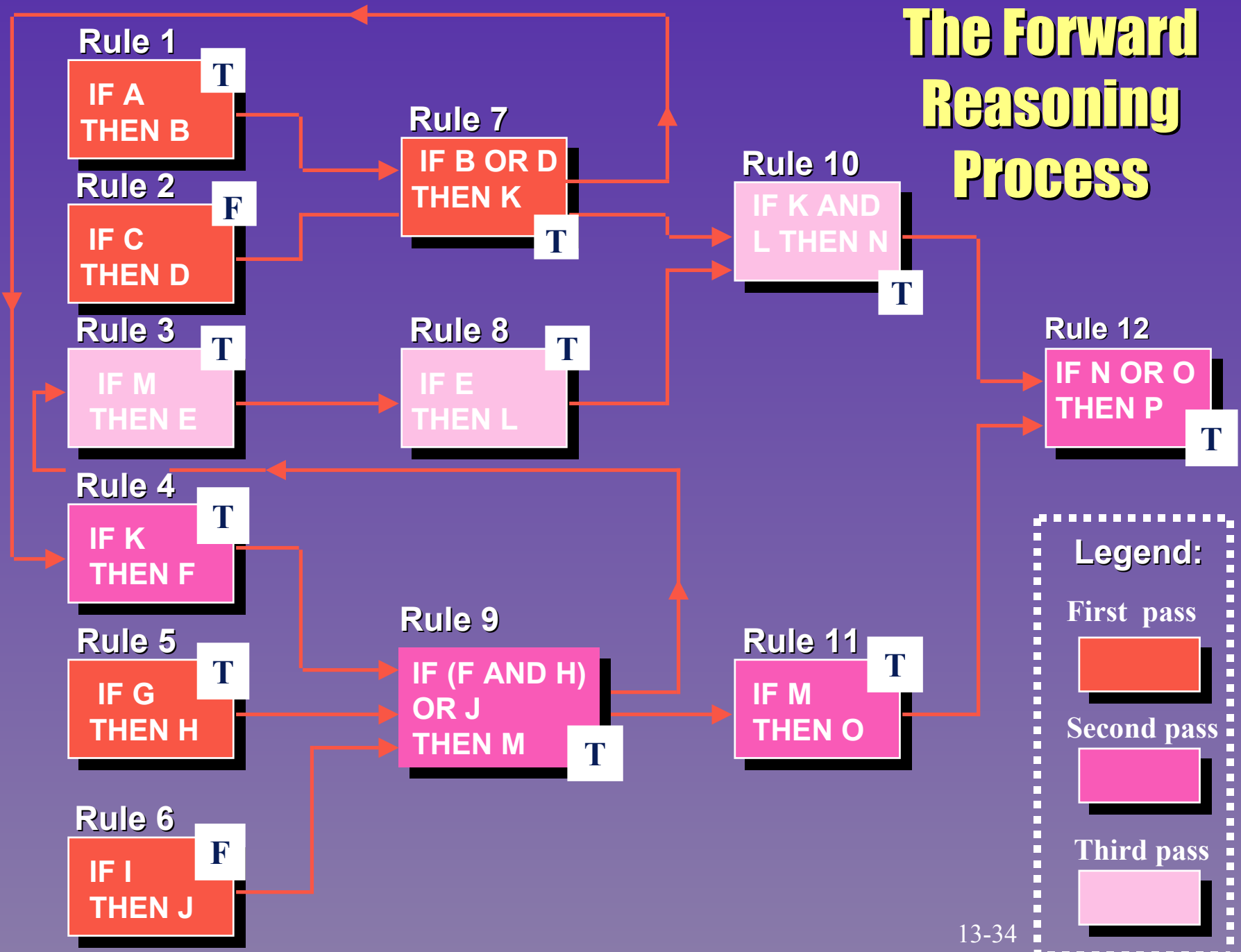
- Performs reasoning by using the contents of knowledge base in a particular sequence
- Two basic approaches to using rules
  - 1. Forward reasoning (data driven)
  - 2. Reverse reasoning (goal driven)

Forward Reasoning (Forward Chaining)

- Rule is evaluated as:
  - (1) true, (2) false, (3) unknown
- Rule evaluation is an iterative process
- When no more rules can fire, the reasoning process stops even if a goal has not been reached

Start with inputs and work to solution

The Forward Reasoning Process

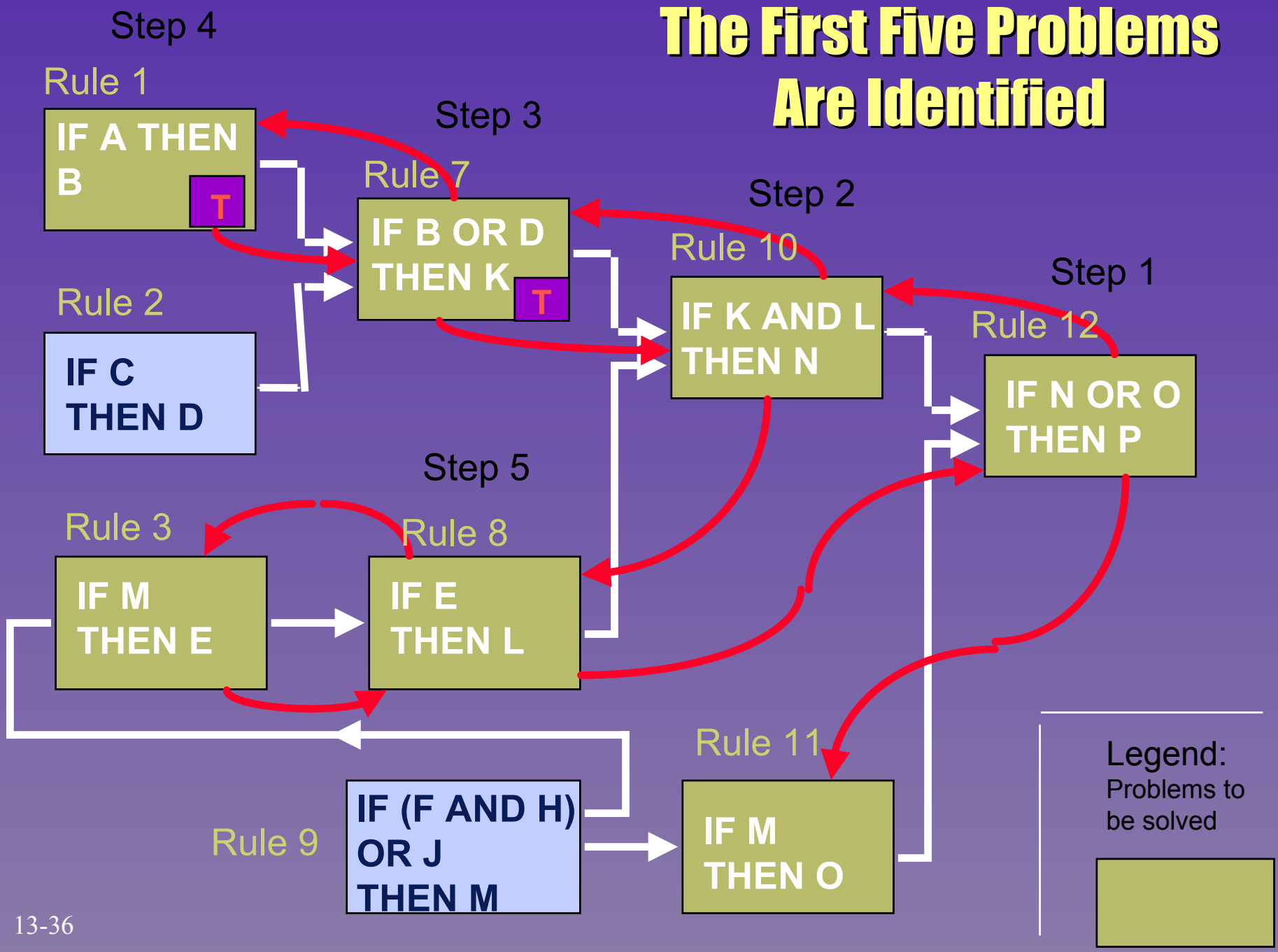


Reverse Reasoning Steps (Backward Chaining)

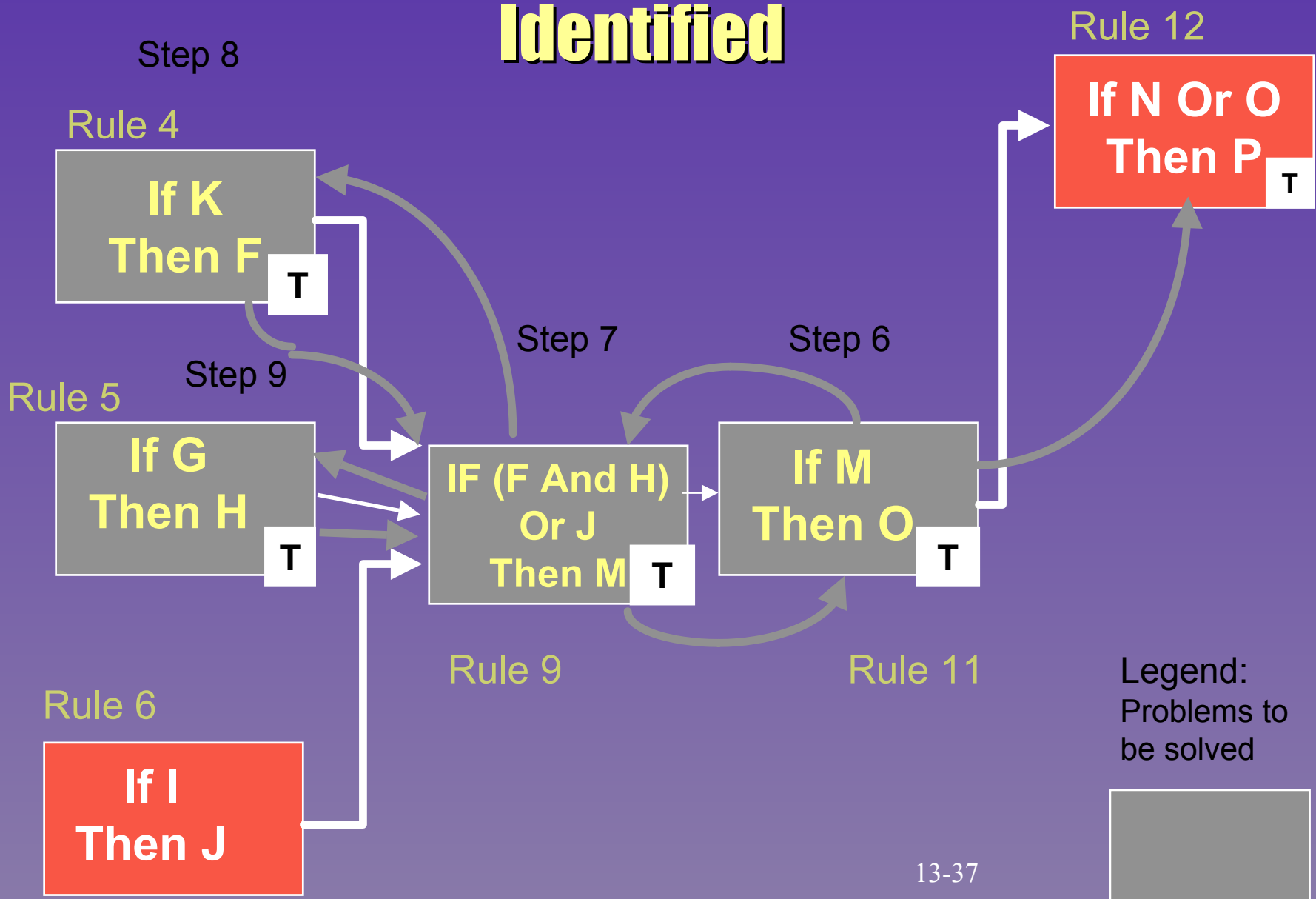
1. Divide problem into subproblems
2. Try to solve one subproblem
3. Then try another

Start with solution and work back to inputs

The First Five Problems Are Identified



The Next Four Problems Are Identified



Forward Versus Reverse Reasoning

- Reverse reasoning is faster than forward reasoning
- Reverse reasoning works best under certain conditions
  - Multiple goal variables
  - Many rules
  - All or most rules do not have to be examined in the process of reaching a solution

Development Engine

- Programming languages
  - Lisp
  - Prolog
- Expert system shells
  - Ready made processor that can be tailored to a particular problem domain
- Case-based reasoning (CBR)
- Decision tree

Expert System Advantages

- For managers
  - Consider more alternatives
  - Apply high level of logic
  - Have more time to evaluate decision rules
  - Consistent logic
- For the firm
  - Better performance from management team
  - Retain firm's knowledge resource

Expert System Disadvantages

- Can’t handle inconsistent knowledge
- Can’t apply judgment or intuition

Keys to Successful ES Development

- Coordinate ES development with strategic planning
- Clearly define problem to be solved and understand problem domain
- Pay particular attention to ethical and legal feasibility of proposed system
- Understand users' concerns and expectations concerning system
- Employ management techniques designed to retain developers

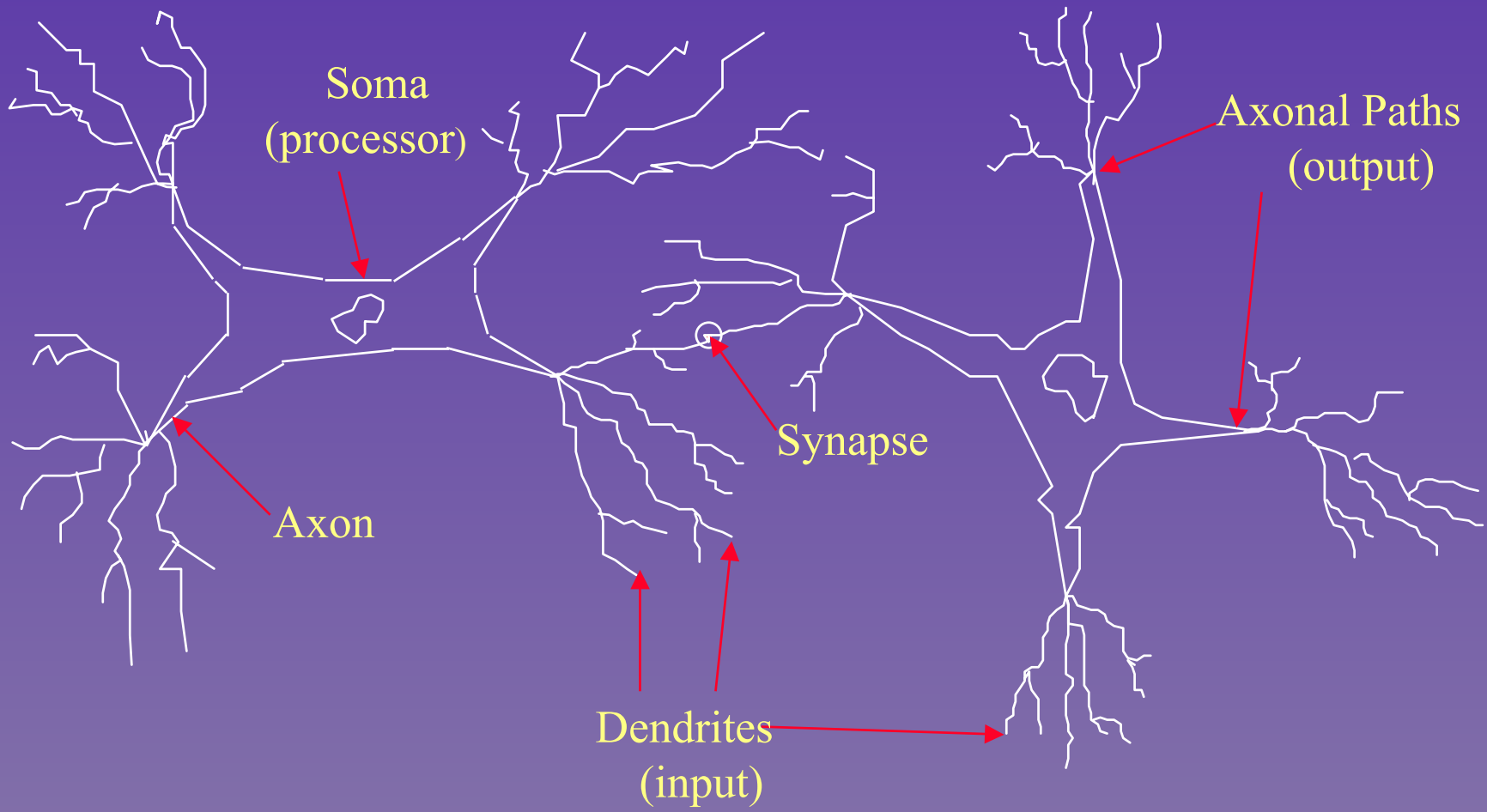
Neural Networks

- Mathematical model of the human brain
  - Simulates the way neurons interact to process data and learn from experience
- Bottom-up approach to modeling human intuition

The Human Brain

- Neuron -- the information processor
  - Input -- dendrites
  - Processing -- soma
  - Output -- axon
- Neurons are connected by the synapse

Simple Biological Neurons



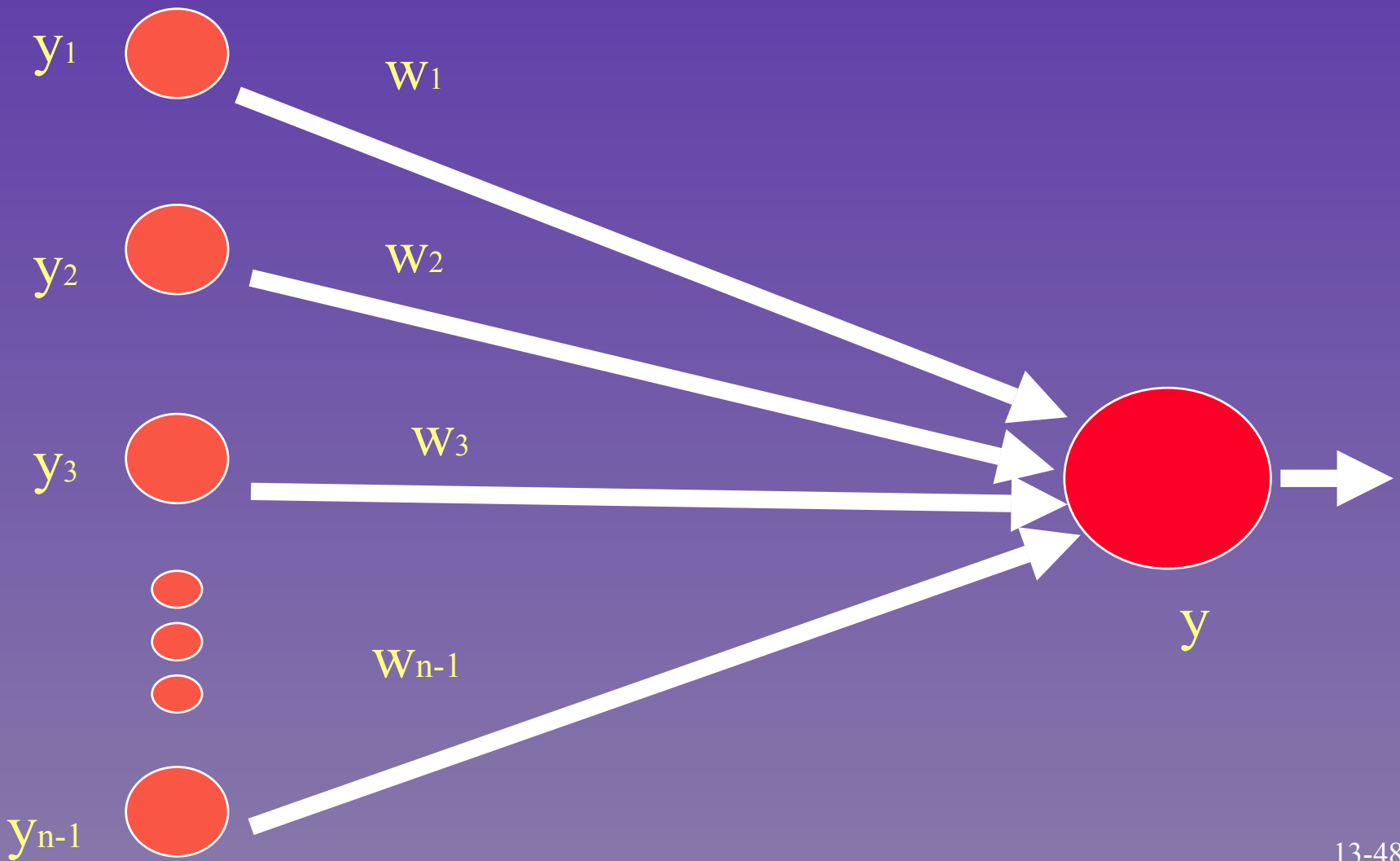
Evolution of Artificial Neural Systems (ANS)

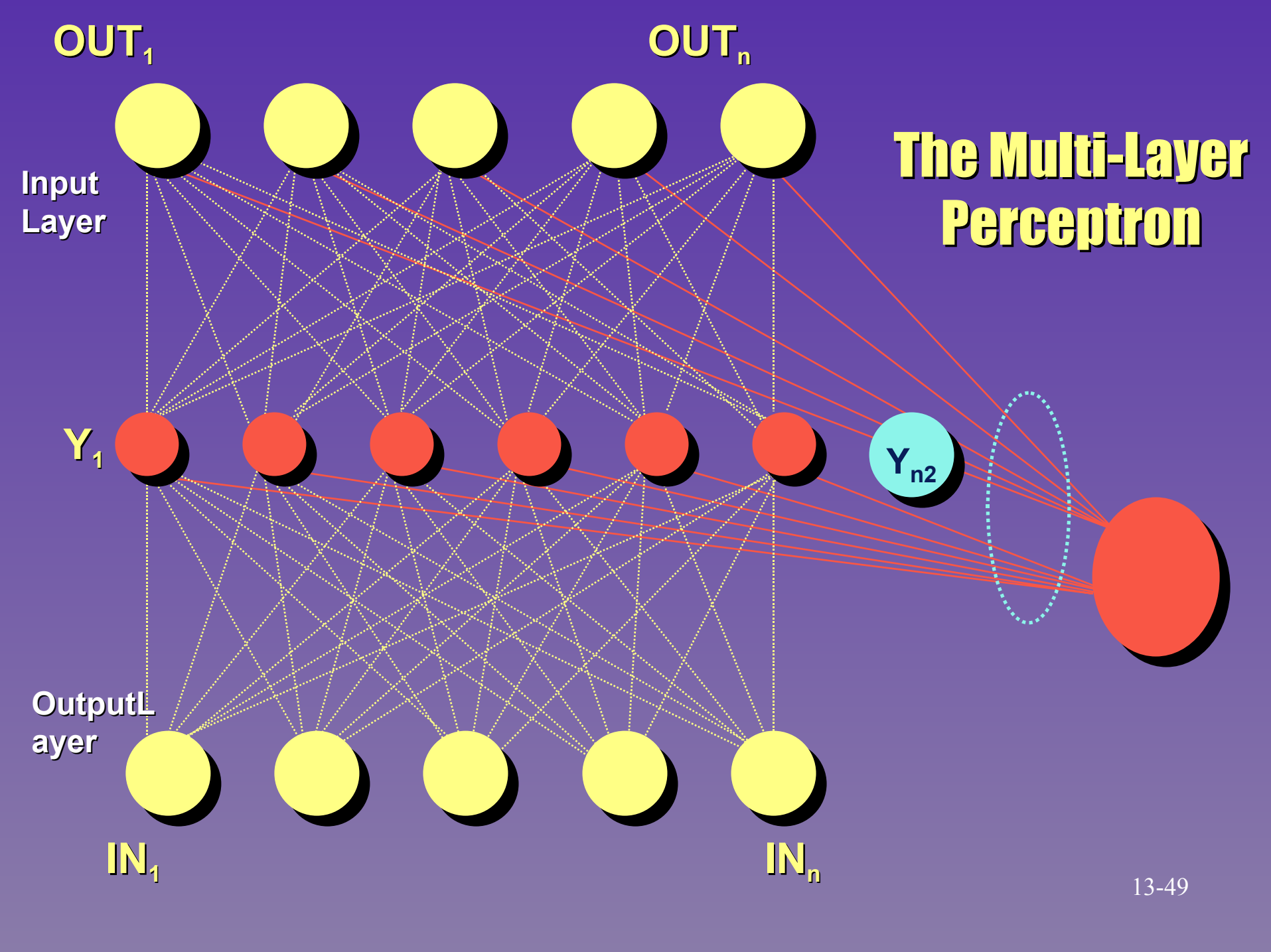
- McCulloch-Pitts mathematical neuron function (late 1930s) was the starting point
- Hebb's learning law (early 1940s)
- Neurocomputers
  - Marvin Minsky's Snark (early 1950s)
  - Rosenblatt's Perceptron (mid 1950s)

Current Methodology

- Mathematical models don't duplicate human brains, but exhibit similar abilities
- Complex networks
- Repetitious training
  - ANS "learns" by example

Single Artificial Neuron





The Multi-Layer Perceptron

Knowledge-based Systems in Perspective

- Much has been accomplished in neural nets and expert systems
- Much work remains
- Systems abilities to mimic human intelligence are too limited and regarded as primitive

Summary [cont.]

- AI
  - Neural networks
  - Expert systems
- Limitations and promise

Case Study

1. A decision support system should let a manager see the possible effects of a decision.

   A) true B) false

2. One type of decision support system (identified by Steve Alter) can make decisions for a manager.

   A) true B) false